Student guide for MAA601 Applied Algebraic Structures

1 Purpose and content

This is a course that is intended to introduce you to certain important topics and structures of applied algebra important in applications in other sciences and engineering. The topics considered in the course are described in the course plan available at
http://www.mdh.se/utbildning/kurser/kursplaner-1.35552?benamning=&kurskod=MAA601&niva=&huvudomrade=&fordjupning=&akademi=&search=Search#

2 Course teacher and examiner

Professor Sergei Silvestrov, sergei.silvestrov@mdh.se, 021 101524

3 Lectures

During the course we will hold lectures which introduce and exemplify certain areas of algebra that are important for application. One of the main purposes of the lectures is to present possible topics for the mandatory examination projects in the course as well as provide ideas and research directions for future studies, for example ideas for projects in a project course or in a Master degree thesis connected to topics in applied algebraic structures.

4 Course evaluation

At the end of this course you will receive an email asking you to give feedback on this course anonymously. This might help us to improve our course further in the future.

5 Examination

To pass this course you will need to complete a project individually on a topic relevant to the course, and present your report orally at a seminar. On each examination moment you can receive a grade of pass (G) or pass with distinction (VG).

If you receive a passing grade (G) on both the project and the seminar you will receive 3 as your final grade. One pass(G) and one pass with distinction (VG) will give a grade of 4. Two pass with distinction(VG) gives a grade of 5.

6 suggestions for examination projects

The list of topics for the projects that you may choose from, subject to the approval of the responsible teacher and examiner for the course, corresponds to content of the course specified in the course plan.

It is also possible to suggest own topic directly relevant to one of the areas in the course plan, subject to approval by the teacher and examiner of the topic including also all literature and materials and detailed description of the project suggestion.

Here are the suggestions for concrete examination projects for Autumn term 2016 in the course Applied Algebraic structures including also concrete topics for the project and some helpful nice info links to wikipedia pages for some basic orientation on the topics with further relevant links and literature references:

1. Symmetry:

Project topic 1.1) Dihedral groups as groups of symmetries, presentations by generators and commutation relations and matrix representations.
Project topic 1.2) Symmetry groups of regular polygons and latices and their applications in crystallography.
Project topic 1.3) Symmetries of differential equations.

`https://en.wikipedia.org/wiki/Dihedral_group`
`https://en.wikipedia.org/wiki/Symmetry_group`
`https://en.wikipedia.org/wiki/Symmetry_in_mathematics`

2. Systems of polynomial equations, algebraic geometry and commutative algebra, etc.
`https://en.wikipedia.org/wiki/Gröbner_basis`
`https://en.wikipedia.org/wiki/System_of_polynomial_equations`
`http://www.mdh.se/polopoly_fs/1.63576!/Menu/general/column-content/attachment/LectureNotesPolynomialSystems.pdf`
David Cox, John Little, Donal O'Shea, Ideals, Varieties, and Algorithms An Introduction to Computational Algebraic Geometry and Commutative Algebra
`http://www.springer.com/us/book/9783319167206`

3. Algebraic analysis of differential equations and other equations, etc.
D. Przeworska-Rolewicz, Algebraic Analysis
`http://www.springer.com/gp/book/9789027724434`
D. Przeworska-Rolewicz: Equations with Transformed Argument. An Algebraic Approach, PWN and Elsevier, Warsaw-Amsterdam (1973).
and/or other literature provided by the teacher.
4. Non-commutative matrix equations. Lyapunov matrix equations, etc.
F. R. Gantmacher, The theory of matrices, Vol.1, Vol. 2
Richard E. Bellman, Introduction to Matrix Analysis

P. Lancaster, M. Tismenetsky, The Theory of Matrices: With Applications
R. Bhatia, Matrix Analysis
and/or other literature provided by the teacher.
5. Lie analysis, Lie algebra, generalized Lie structures, hom-algebraic structures, non-associative algebra, deformations of algebraic and geometric structures in physics and engineering
https://en.wikipedia.org/wiki/Lie_algebra
https://en.wikipedia.org/wiki/Lie_bracket_of_vector_fields
https://en.wikipedia.org/wiki/Lie_group
https://en.wikipedia.org/wiki/Lie_point_symmetry
https://en.wikipedia.org/wiki/Lie_superalgebra
http://arxiv.org/pdf/math/0609501.pdf
and/or other literature provided by the teacher.
6. Non-commutative algebra and linear representations in physics and engineering
Literature provided by the teacher.
7. Rewriting Systems and operads in computer science and physics Lars Hellström, Sergei D Silvestrov, Commuting Elements in Q-Deformed Heisenberg Algebras
http://www.worldscientific.com/worldscibooks/10.1142/4509
and/or other literature provided by the teacher.